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Dear Bob:

As requested, we have reviewed the data you sent us last month from the Southeast Missouri Waste sites where 2,3,7,8 tetrachlorodibenzodioxin (TCDD) has been identified. The review was performed by members of the Center for Environmental Health and is enclosed.

You will note that we have made site specific recommendations rather than attempting to set a universal "how clean is clean" standard for TCDD. To set a standard that could apply to all situations would force us to assume worst case (e.g. with a large nearby population, ground water contamination, etc.). Therefore, we felt that we could be of more practical assistance by providing you with recommendations tailored to the information provided on each site.

I hope this is of help to you in your analysis of clean-up needed. Please feel free to send us any additional information that you would like us to review, and/or give us a call if you have any questions.

Sincerely yours,

Georgi
Georgi A. Jones
Superfund Implementation Group
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Enclosure



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SUPERFUND RECORDS

EPA-ARHM/HAZM

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Region VII K.C., MO

HEALTH ASSESSMENT OF SOUTHEAST MISSOURI WASTE SITES
CONTAINING 2,3,7,8 TETRACHLORODIBENZODIOXIN (TCDD)

Introduction

TCDD is one of the most toxic man-made organic chemicals known. In addition to being extremely toxic when given as a single dose, it is persistent in the environment and in living organisms. TCDD has a very pronounced cumulative toxicity. In animals, it has been shown to affect reproduction, to cause suppression of the immune response, and to be carcinogenic in rodents. In rats, a daily dietary dose of 0.001 ug/kg body weight is a "quasi" no-effect level. Life time studies have not been conducted in species other than rodents. Subhuman primates and guinea pigs are extremely sensitive to the toxic effects of TCDD. The oral DL_{50} in guinea pigs, for example, is 0.7 ug/kg, while it is 44 ug/kg in rats. The ration between the rat oral LD_{50} dose and the "no effect level" of 0.001 ug/kg (at this dose, minor morphological changes are still noted in the liver) is 44000. If this ratio was the same for all species than in the guinea pig, the no effect level for life-time exposure would be 0.7 ug/kg: 44000 or 1.6×10^{-5} ug/kg which is the same as 0.016 ng/kg. In general, animal studies show that there is great variability in response to the toxic effects to TCDD among species. It is not clear where humans fit on this response scale. It is assumed that they would be more sensitive than the rat, but less sensitive than the guinea pig. Thus, any amount of TCDD detected with presently available analytical methods would still present some, although poorly defined, risk if absorbed by humans. (For more background information and detailed explanation the references given at the end of this document should be consulted.)

However, it has also been demonstrated that polychlorinated dibenzodioxins including TCDD are present in our environment in measurable levels. Fish in Lake Ontario have TCDD levels from none detected in 162 ng/kg in Lake Huron from none detected in 29 ng/kg. Most samples from Lake Erie, Lake Superior and Lake Michigan were negative in a study conducted by the New York State Department of Health. TCDD levels in fish near chemical companies in the Arkansas river and the Tittahawassee river and Saginaw Bay have ranged from 15-480 ppt (ng/kg). In the Housatonic river, fish TCDD levels range from 3-22 ng/kg. TCDD has also been found in beef fat and in fly ash from incinerators. Furthermore, the mean yearly exposure to TCDD from cigarette smoking has been calculated to be 2 ng/smoker. (NRCC 1981). All of these findings suggest that a general background contamination of the environment with TCDD exists.

In order to reduce the total environmental burden and to protect human health and our environment, point sources of TCDD from industrial waste should be reduced as much as is practical. TCDD is highly hydrophobic, degrades rapidly on exposure to UV light if hydrogen donors are available, is persistent in soil with a half-life of up to 10 years, does not readily migrate through soil and is only slightly taken up by root plants. A few strains of soil bacteria are able to degrade it at a slow rate.

How useful and/or necessary such a clean up of point sources will be will vary among different sites and will have to be developed for each specific site. In general, the following factors will have to be considered:

1. Total amount of TCDD present
2. Concentration in different media

3. Proximity to surface and/or ground water

4. Proximity to human habitats, farmlands or pastures.

Human uptake of TCDD from the environment would be primarily through the inhalation of dust which contains TCDD and the ingestion of wildlife or fish which has been contaminated. Cattle and other livestock (including chickens) could become contaminated by grazing in areas which contain TCDD. Meat and other animal products could then transmit TCDD to humans. Absorption of TCDD by humans directly from soil through dermal contact would be negligible unless TCDD levels were extremely high; similarly, levels in air and water would contribute only small amounts in relation to food sources and dust, since TCDD is not volatile nor water soluble to any great extent.

Guidelines for Cleanup of the TCDD Contaminated Sites in Missouri

Because of the inherent difficulties when cleanup attempts of the environment are made, the recommendations outlined below should only be perceived as guidelines and may in some cases have to be readjusted as more is learned about the existing conditions in Missouri. These guidelines should also not be construed as being applicable to other sites or other chemicals. They are also made without any review or appraisal of the methodology used to determine TCDD levels. They are solely based on the information supplied by EPA Region VII.

Recommendations:

1. All drums containing liquids, solids, trash from ND, 50ppm or above which are present at the Syntex facility at the Erwin barn in Verona, and the drum filter cake at the Rusha Farm should be incinerated.
2. If it is possible, the Neosho digester and the Steel tank stored at Ft. Crowder Banker should be incinerated. (We have no specific information about the incinerator to be used, nor the configuration of the digester so we do not know how viable this recommendation is.)
3. No recommendations can be made for areas where the TCDD concentrations is unknown. Before sampling is done, a sampling plan should be developed which should consider surface area as well as depth of contamination so that calculations can be made as to how many m³ of soil or sediment are contaminated.
4. The riding arenas previously tested by CDC in 1974 and 1976 need to be retested; levels may be lower now.
5. On the Erwin farm, if the TCDD is in areas where livestock and chickens have no contact with it, no remedial action would have to be taken; however, if cattle or chickens do have contact with

it, it should be removed to a level of 50ppt* which should be a reasonable limit of detection for laboratories. (This would not be necessary if it can be demonstrated that animals have not been contaminated.)

6. It should also be determined whether milk and eggs from the Erwin farm contain TCDD and whether the farm family consumed these products.
7. Unless there is evidence that contaminated soil is migrating out of fill area of the road, this material could be left (TCDD adheres to soil). However, further construction crews would have to be warned of the hazardous material under the road and the area should be posted.
8. It is assumed that workers engaged in sampling or otherwise handling TCDD contaminated material will use procedures and protective gear as outlined by NIOSH.
9. It is not clear from the information provided by EPA whether the soil that may have to be removed will be incinerated. This would be possible if only small amounts are involved. However, large amounts might have to be stored at a safe site. If such a site does not exist, removal and concentration of the material in one place might increase the hazard.

*Analytically we believe the number of 50ppt represents a value which (1) a sufficient number of laboratories will be adequately able to measure, (2) may prevent unnecessary excavation in the State of Missouri and, (3) provides a reasonable margin of safety until more definitive epidemiologic information is available.

Summary

Further information including extent of the contamination (possibly outlined on a map) is needed to determine what soils and sediments should be removed. In general, in remote areas which are not adjacent to surface or ground water, ppb levels of TCDD could be left. However, in some situations such as the Erwin farm, clean up would have to proceed to the ppt level. If contamination is extensive, this may not be feasible. In such situation, the most highly contaminated areas with the greatest potential for human exposure should be addressed first.

References

National Research Council of Canada (1981). Polychlorinated Dibenzo-p-dioxins. Publication NRCC No. 18574 of the Environmental Secretariat. Publication NRCC/CNRC, Ottawa, Canada K 1 A 0 R 6, 1981

Kimbrough, R.D. (ed.) 1980. Halogenated bi phenuls, terphenyls, naphthalenes dibensodioxins and related products. Topics in Environmental Health 4:406 pp.